



Manufacturing with Intel® Pentium® 4 Processor in the μ PGA Form Factor

With Reference Design
Part III



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Session Agenda

- Mechanical Features
- Reference Design
- **Manufacturing Considerations**
- Production Logistics

Manufacturing Considerations: Handling Intel® Pentium® 4 processor with 478 pin μ PGA

Packaging: A New Technology

- Pentium 4 (478 pin) μ PGA packaging combines smaller diameter pins and tighter pin spacing
 - Pin diameter now 12 Mil vs. 18 Mil (for previous processors)
 - Pins spacing is now 50 Mil vs. 100 Mil (for previous processor)
 - Pins are susceptible to bending and damage
- The Pentium 4 (478 pin) processor utilizes new 50 mil pitch Zero Insertion Force (ZIF) technology
- As A Result...

**New Handling and Assembly
Procedures Must Be Implemented
To Avoid Bent or Damaged Pins**

Manufacturing Considerations: Handling

Careful handling of the Intel® Pentium® 4 (478 pin) processor in the μ PGA package is essential.

- Effects of damage may not always be immediately apparent.
- Material should be kept in ESD protective trays until it is ready for use.
- Units should be handled by the substrate edge.
- Any units dropped during handling should be scrapped.
- Attempts to physically remove contamination induced by poor handling and storage practices could compromise reliability. However, pressurized air can be used to blow off loose particles.

Manufacturing Considerations: ESD Sensitivity

Processors should only be unpacked from boxes at ESD workstations

- All persons handling processors should be properly grounded.
- All work and storage surfaces for processors should be properly grounded.
- All tools and test equipment used to install or rework processors should be properly grounded.

Use proper storage and material transfer

- Transfer material using ESD safe trays, not by hand
- Remove processors from trays when they are ready to be used
- Units should be handled by the substrate edge

For more information on ESD, visit Intel's website at:



<http://developer.intel.com/design/quality/eosesd/index.htm>

Manufacturing Considerations: ESD Sensitivity

Use proper storage and material transfer

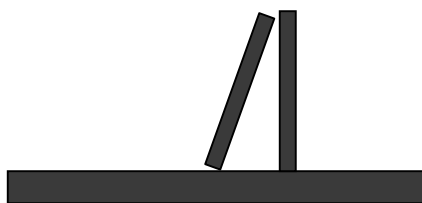
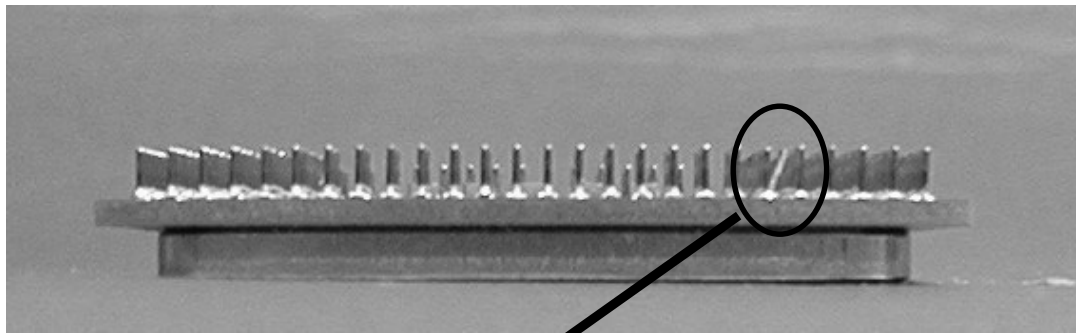
- Persons handling ESD protective trays should insure that pins are not damaged from contact through the bottom of the tray. The packing contains a corrugated shim on the bottom of the shipping tray stack to protect the leads. The pins should not come into contact with any surface.

For more information on ESD, visit Intel's website at:
<http://developer.intel.com/design/quality/eosesd/index.htm>

Manufacturing Considerations: Visual Inspection and Pin Rework

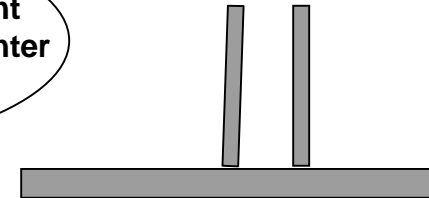
Before installing the processor, inspect the package for:

- Debris on or within the pins which cannot be blown off
- Bent or misaligned pins



**Bent pin > 17 mils off center
Reject and Scrap**

**Reject and scrap any unit that has bent
pin(s) that is greater than 17 mils off center
Note: pin diameter is 12 mils**



**Bent pin \leq 17 mils off center
is Reworkable**

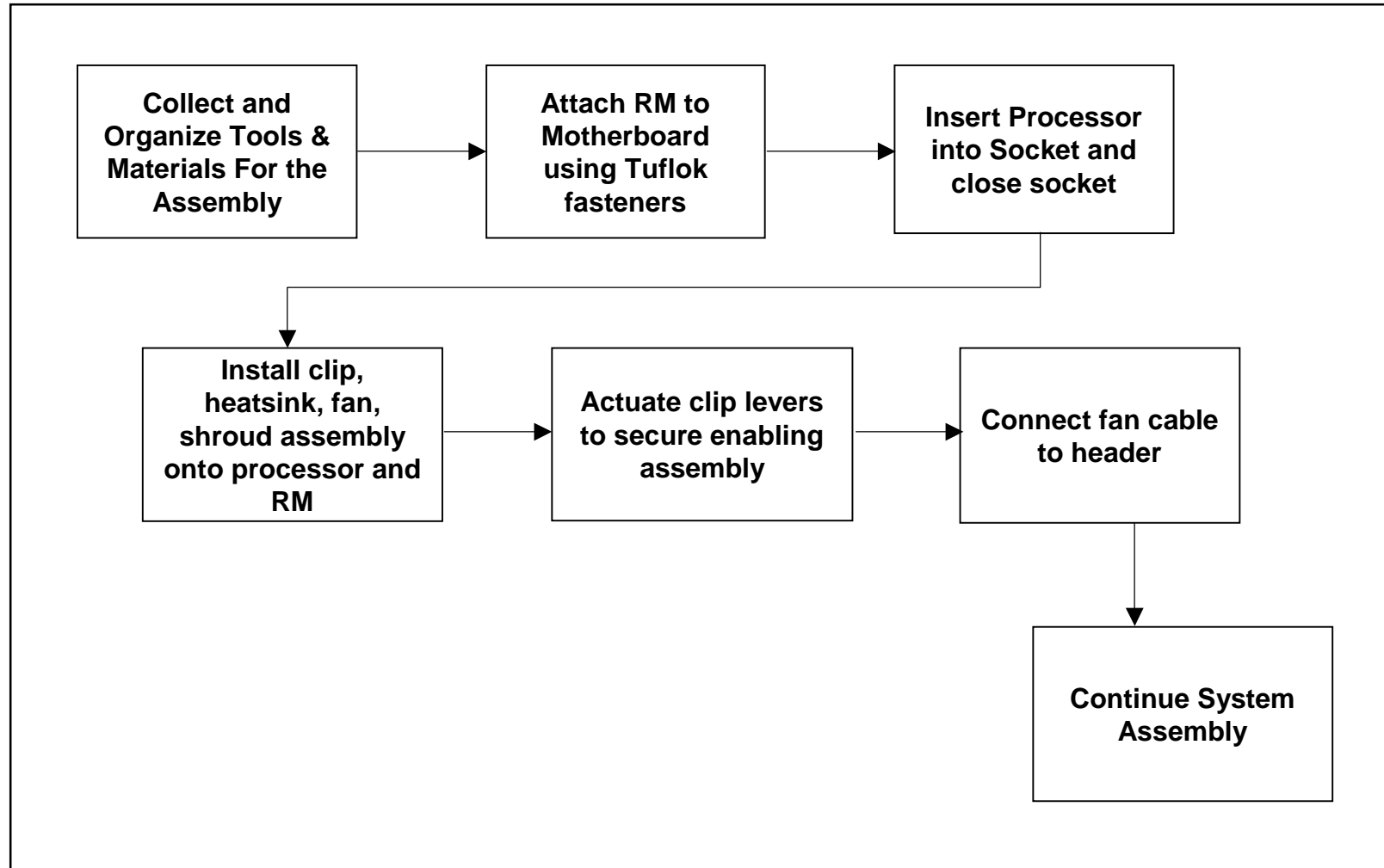
Manufacturing Considerations: Visual Inspection and Pin Rework

- If a large number of units require rework and no in-house capability exists for lead conditioning:
 - Use of an outside service that has automated lead conditioning capabilities could be subcontracted.
 - Purchase lead conditioning equipment for in-house capability.

Ever Tech* MPR200*
 - Manual lead straightening tools can be acquired at:

NAPCO Tool - Tempe, AZ USA
telephone : (480) 968-5586
12 mil pin diameter straightener

Manufacturing Considerations: **Process**

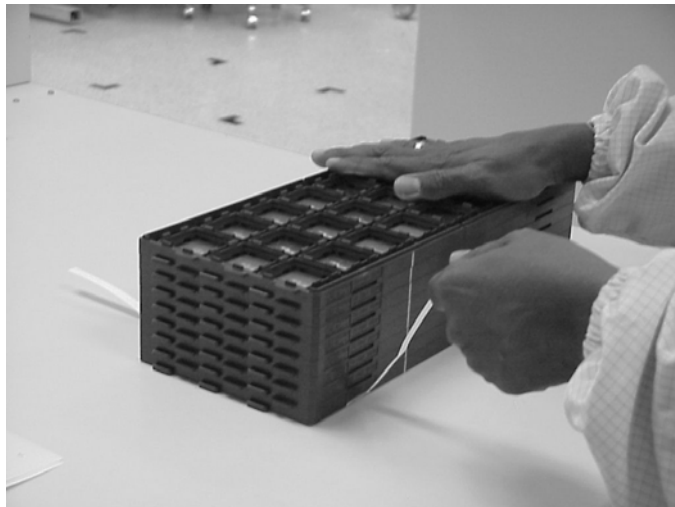


Manufacturing Considerations: Assembly



Strap Removal Procedure

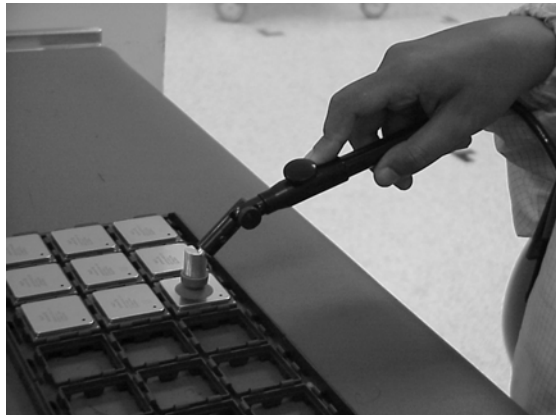
- Place the tray stack with heat spreader side facing top on an ESD safe surface.
- Use an industrial safe scissors, to cut off the straps.
- Pull off the straps from the tray stack.



Tray Handling Procedure

- Tray stacks should be securely fastened during transport.
- A straight tray lift procedure is recommended when removing tray from stack to prevent damage to processors in tray underneath.

Manufacturing Considerations: Assembly



- Store trays at a height level for ease of sighted access.
- Pick up a processor package from tray using an ESD safe Vacuum Wand
- Have the other hand hold the processor package by sides to prevent damaging pins or contaminating the heat spreader.
- Release the processor packages by pressing the vacuum release button. Allow for cushioned and ESD safe, pin side down, unloading and transportation in the manufacturing line.
- Visually inspect the processor for bent pins.
- Replace processor or repair damaged pins on processor. (Refer to foil 8 this presentation, Visual Inspection and Pin Rework).

Manufacturing Considerations: Tooling

ESD Safe Vacuum Wand

- Vacuum Wand Information

- Manufacturer : Slimline Mfg Corp., PO Box 3295
Scottsdale AZ 85271. Phone : (480) 967 5053
- Model : SLIVWC9
- Always refer to Vacuum Wand manufacturer for
installation guideline.

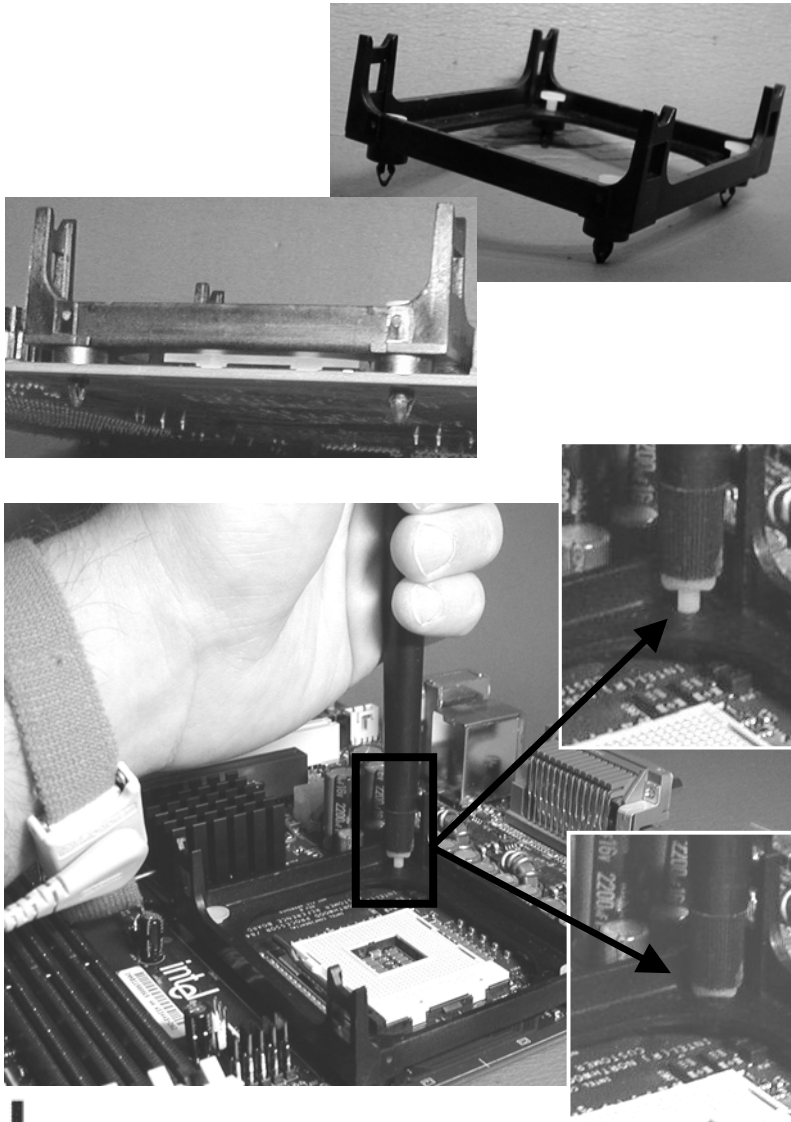
Industrial Safe scissors

- Scissor information

- Manufacturer : William Whiteley
- Supplier : Farnell (www.farnell.com)
- Order code : 709-9307
- Description : Safety "Safe-T-Guard" *

Manufacturing Considerations: Assembly

Assemble RM to motherboard



- The retention mechanism assembly should contain the RM body with 4 Tuflok fasteners.
- The assembly should arrive from the supplier with the Tuflok fasteners pre-assembled to the RM in a partially inserted position.
- The Tuflok body (black) should be fully seated in the RM holes with the tail protruding out the bottom of each hole. The Tuflok pin (white) should be only partially inserted into the fastener body.
- Install the retention mechanism onto the motherboard by snapping the protruding portions of the Tuflok fasteners into the four motherboard holes.
- Complete the installation by pushing the The Tuflok pin (white) fully into the Tuflok body (black) until it seats flush.

Manufacturing Considerations: Assembly

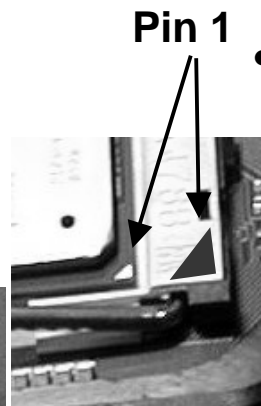
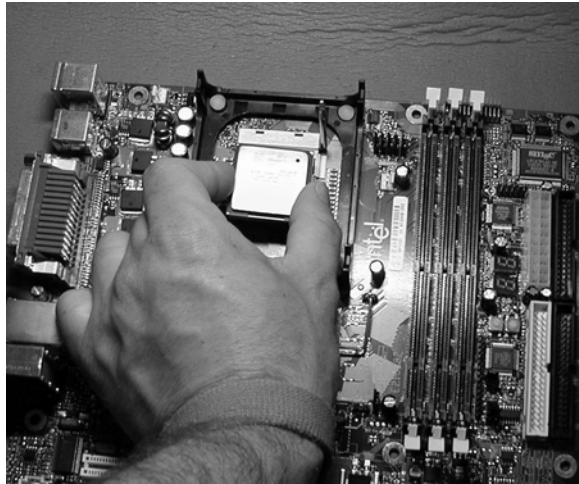
The Intel® Pentium® 4 processor (478 pin) utilizes a new μ PGA packaging technology that includes 50 mil pin spacing and 12 mil diameter pins. This new technology makes the Pentium 4 (478 pin) package inherently more susceptible to pin bending. Additionally, a new Zero Insertion Force (ZIF) socket has been enabled for its use.



- Pickup and hold processor package by its sides to prevent damaging pins or contaminating the heat spreader.
- Alternatively processor package can be pickup using a vacuum wand (Refer to page 12 & 13).
- Visually inspect the processor for bent pins.
- Replace processor or repair damaged pins on processor. (Refer to foil 8 this presentation, Visual Inspection and Pin Rework).
- Visually inspect the socket for damage. Ensure the socket is free of debris and that the socket holes are clear of any contamination.

Manufacturing Considerations: Assembly

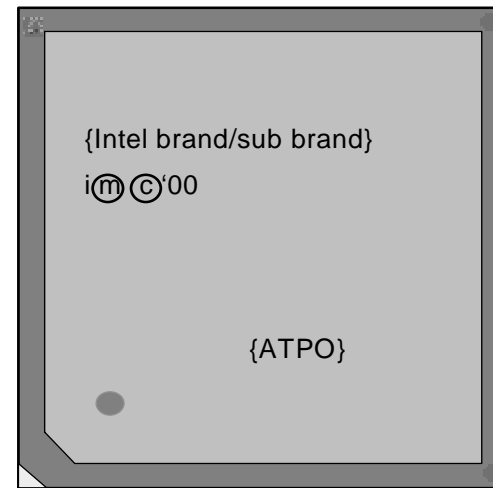
Install processor into socket



- Ensure that the socket lever is fully opened and perpendicular prior to insertion of processor to prevent socket damage.
- Holding the processor package by its sides, install processor into socket. First ensure correct pin 1 orientation and then carefully seat the package into the socket. You may need to push down on the processor with a light force. Ensure processor base is sitting flush with the socket.
- Actuate the socket by pushing down on lever until it locks in place (socket lever lock is fully down and in locked position).

Manufacturing Considerations: Pin 1

Intel® Pentium® 4 processor (478 pin)



Package Pin 1 Designator

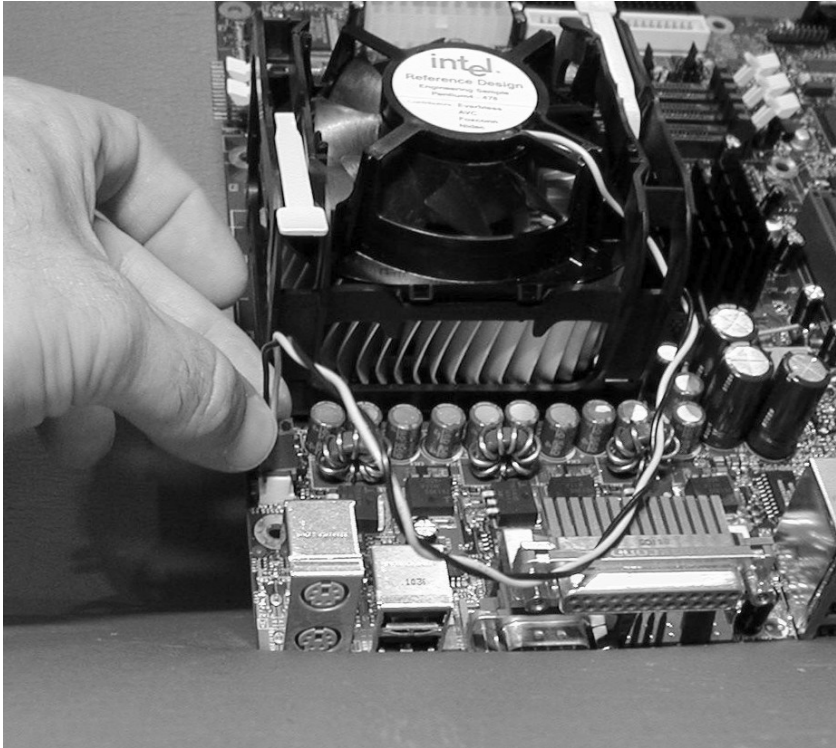
Manufacturing Considerations: Assembly

Install clip, heatsink, fan, shroud assembly



- Whenever possible, it is recommended to attach the board to the chassis before installing the heatsink.
- The clip, heatsink, fan, and shroud should arrive from the supplier as an assembly.
- The heatsink should have TIM (thermal interface material) pre-applied to its base.
- Ensure that clip levers are in open position prior to installation on the motherboard.
- The assembly should be placed over the processor and pushed down to engage the clip hooks with the RM windows.
- The clip hooks should snap into place. Use visual or tactile inspection to ensure that all four hooks have fully engaged.
- Actuate clip levers (2 places) by rotating the lever into its closed position. Levers should be rotated until encountering hard stop.
- Levers can be actuated sequentially or simultaneously.
- Note that the preload is applied through engagement of the two clip levers described above. No special instruction is required.

Manufacturing Considerations: Assembly

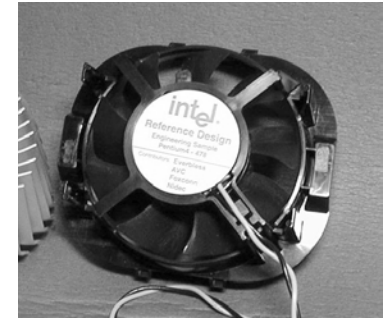
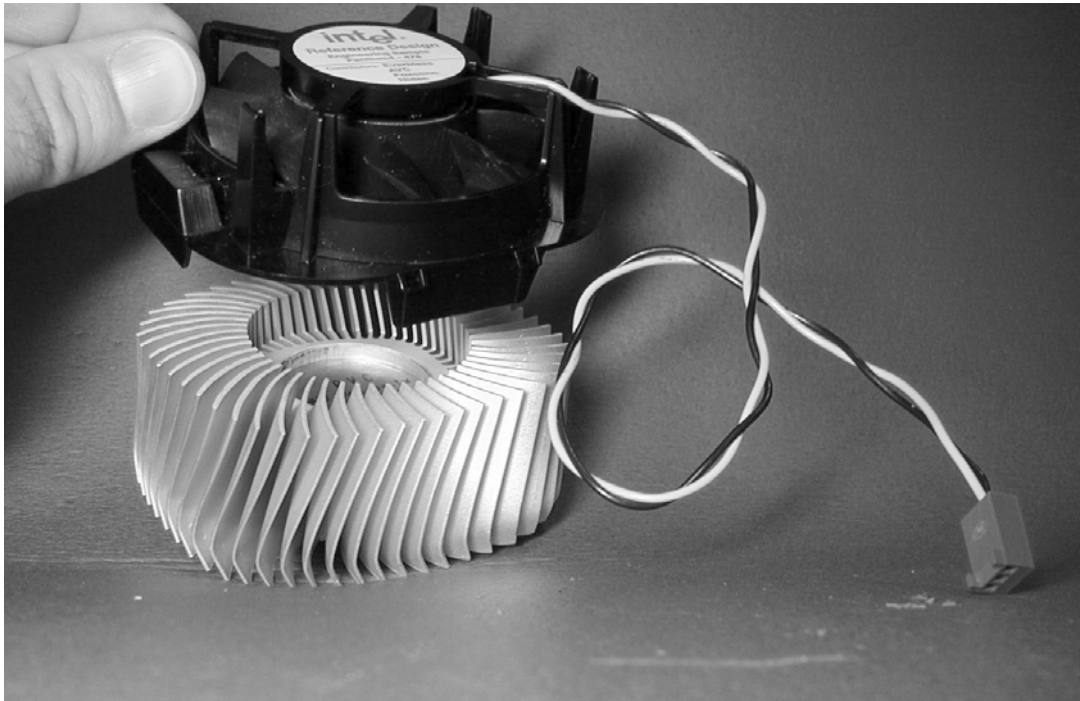


- Ensure processor heat spreader contacts heatsink base.
- Connect the fan power cable to fan header.

- **Assembly Completed**

Manufacturing Considerations: Disassembly

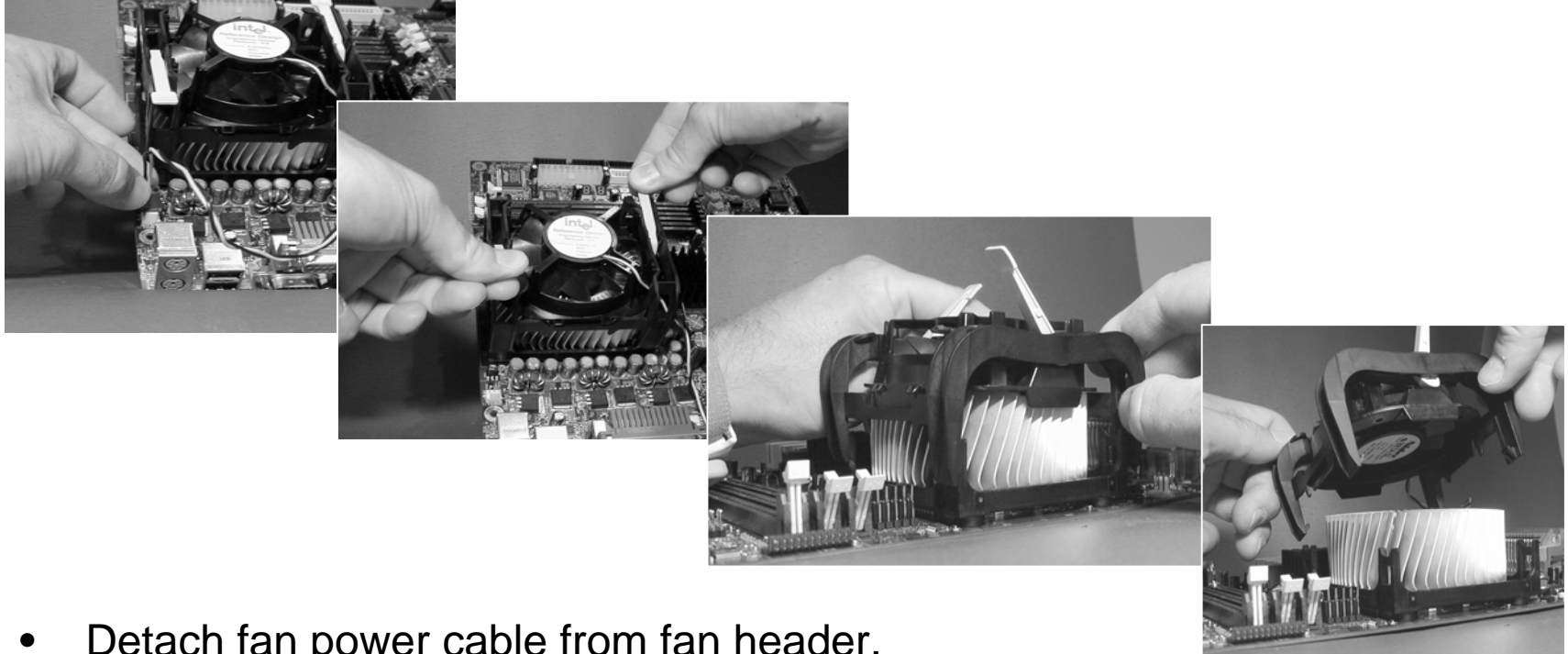
Fan Removal



- After removal of the clip /shroud /fan assembly from the heatsink and RM, the fan is accessible for removal. Figures to the right show Fan & shroud separately and together (respectively).

Manufacturing Considerations: Disassembly

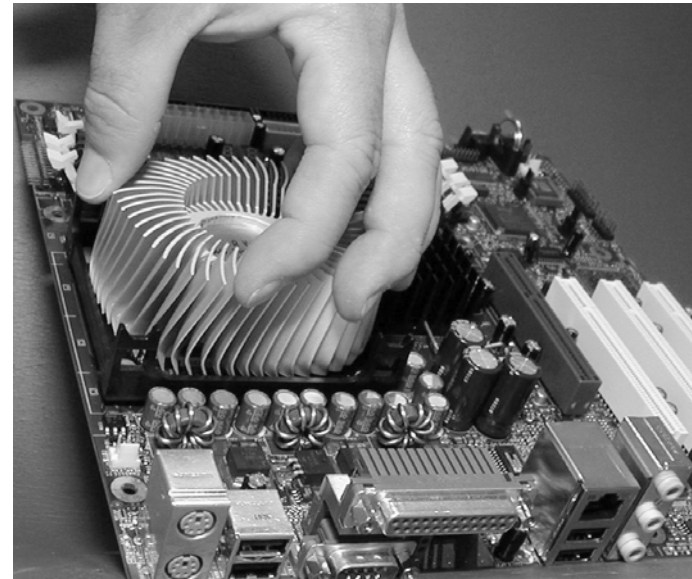
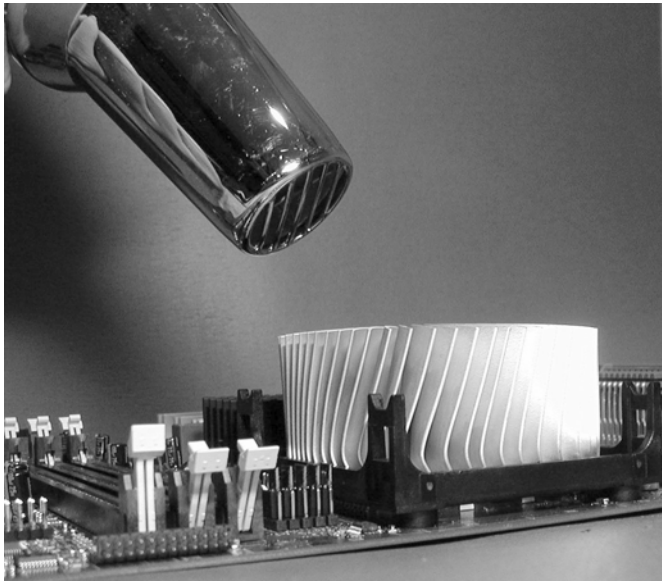
Heatsink Attach Clip Removal



- Detach fan power cable from fan header.
- De-actuate the clip levers in two places by rotating lever arms to the open position.
- Using a flathead screwdriver or hand, unlatch the clip hooks in four places to release the clip from the RM as shown above.
- Remove the clip /shroud /fan assembly from the heatsink and RM as shown above.

Manufacturing Considerations: Disassembly

Heatsink Removal



- After removal of the clip /shroud /fan assembly from the heatsink and RM, the heatsink is accessible for removal.
- Ensure that the TIM is heated prior to removal of heatsink. Attempting to remove heatsink while TIM is below its phase change temperature (~50C) may result in accidental removal of the package from the socket which may damage package and socket contacts.
- Once the TIM is preheated to at least 50C, remove heatsink from package by gently twisting the heatsink.

Manufacturing Considerations: Disassembly

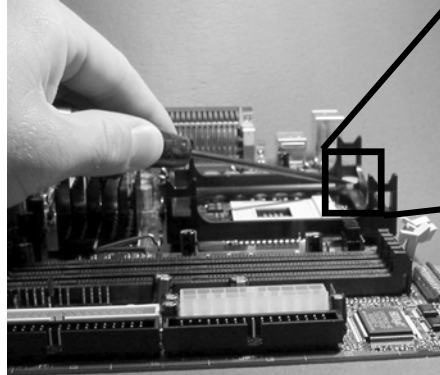
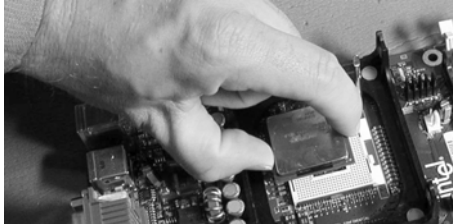
Thermal Interface Material Removal



- Using a soft cloth, remove all Thermal Interface Material (TIM) from the processor and heat sink as needed. Use isopropyl alcohol with a soft cloth to thoroughly clean the surfaces.

Manufacturing Considerations: Disassembly

Processor and Retention Mechanism Removal



- Unlock lever and pull upwards.
- Remove processor by holding processor package by its sides and pulling straight out of the socket.
- Using a small flathead screwdriver, pry up the Tuflok pins (white) such that the pin head stand off the Tuflok body (black) by approximately 5 mm. Repeat this in four places.
- Pull upward on a single corner of the RM so as to direct majority of force on a single Tuflok fastener. The tail of the Tuflok body will detach from the motherboard hole. Repeat in four places.

Bottom view



Locked position
(pushed down)



Un-locked position
(pried up)